MGB - May, 1955, No. 12

Lederberg, E. M. Equivalence of the Mal_1 and Lp_2 loci in E. coli K-12.

Independent descriptions have been made of a locus, Mal_1, controlling maltose fermentation and another, Lp_2, determining the susceptibility to the virulent lambda mutant, lambda-2. Both were known to be linked to S (streptomycin) and usually hemizygous in otherwise heterozygous diploids. Recent evidence supports the hypothesis that these diverse phenotypes are controlled at a single locus with apparently pleiotropic effects:

(1) existing stocks were found as either of two alternatives, Mal_1^- and Lp_2^r or as Mal^+ and Lp_2^s.

(2) failure to obtain $Mal^+Lp_2^r$ and $Mal_1^-Lp_2^s$ crossover recombinants in large scale progeny tests when these stock cultures were crossed.

(3) Mal^+ reversions isolated as papillae from $Mal_1^-Lp_2^r$ colonies on EMB maltose proved to be Lp_2^s. From the latter $Mal_1^-Lp_2^r$ reappeared among the resistant survivors after selection with lambda-2. This mutation cycle has been repeated several times and in several stocks.

Exceptional Mal^+ but lambda-2 resistant isolates which have also occurred have so far proved to be independent, nonallelic mutants at least one other locus, Lp_1. This is not located in the S region according to both the linkage and the heterozygosity vs hemizygosity criteria. Several of our older diploid stocks are now known to be segregating for both Lp_2^r Mal_1^- and Lp_1^r. Other types, possibly alleles of (Mal_1 Lp_2) still under investigation include: 1) a mutable type giving heavily papillate colonies on EMB maltose; 2) an intermediate maltose fermenter which gives an "intermediate" resistance to lambda-2; and 3) a temperature-sensitive variant identical with ($Mal^+Lp_2^s$) at 37°, and with ($Mal_1^-Lp_2^r$) at 37°.

Several Mal^- mutants genetically distinct from Mal_1^- have also been isolated following exposure to UV. Their reaction to lambda-2 is unchanged. All of them, including Mal_1^-, are competent glucose fermenters at 37°. Resistance to lambda-2 can be selected on lambda-6 (kindly sent by Dr. J. J. Weigle) and on p-14, (the sewage phage previously described) as well as on lambda-2. The first of these attacks only Lp_1^s bacteria (lambda-1 sensitive) while the latter attack Lp_1^+ and Lp_1^r as well.

A preliminary attempt to link the fermentation and phage effects of the (Mal_1 Lp_2) locus by assuming that amylose might serve as a receptor for lambda-2 was negative. Samples of starch ("waxy", soluble, or dextrin) had no demonstrable effect on blocking the adsorption of lambda-2.

Despite frequent purification, stock cultures of W-1 and its Mal_1^- derivatives (notably W-1177 and W-1317) often contain Mal^+ components. If data on the Mal+/- segregation are desired from a cross, the purity of each parent should be verified.

What should this locus be called? Although the Mal_1 notation has priority, we have adopted the temporary expedient, (Mal_1 Lp_2).--Department of Genetics, University of Wisconsin. Madison, Wisconsin.